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COMPARATIVE ARTERIAL OSCILLOGRAPHIC INVESTIGATIONS OF THE FOREARM AND LEG IN YOUNGER AND OLDER PERSONS

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COMPARATIVE ARTERIAL OSCILLOGRAPHIC INVESTIGATIONS OF THE FOREARM AND LEG IN YOUNGER AND OLDER PERSONS

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Many authors (refs. 1-3) point out that the degree of oscillation /203*
in the arterial oscillogram depends on the elasticity and width of lumen of the arterial vessel, aside from the significant hemodynamic values such as systolic discharge of the heart, degree of the systolic, mean and pulse pressure, peripheral resistance, etc. Elasticity and width of lumen depend, in turn, also on the muscle tone of the vessel (ref. 1). With diminished muscle tone of the vessel the module of elasticity of the vascular wall also diminishes, whereas the oscillometric index (OI) increases, and vice versa.

Various tests were conducted to diminish and evaluate the vascular muscle tone with oscillometric methods: heating, loading, ischemia of limbs, effect of nitroglycerine, acetylcholine, etc. (ref. 4). The tests gave weaker results in sclerotic arteries because of the rigidity of the vessel wall.

In our comparative arterial oscillographic examinations of the forearm and leg in younger and older persons we used a specially devised test to influence the vascular tone. It consists of a temporary ischemia of the limb.

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*Numbers given in the margin indicate the pagination in the original foreign text.

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Method. Our investigation concerned 145 persons of both sexes, divided by age into two groups, 20-50 years and 60-90 years. The first group consisted of 56 persons and the second of 89 persons. They were previously examined, clinically and otherwise, in order to eliminate those with any signs of cardiac or vascular damage. In the group of older people we were most careful to eliminate those with any anamnestic and objective indications of local or generalized arteriosclerosis, high blood pressure, diabetes mellitus, varicose veins, former thrombophlebitis, etc.

The investigations were conducted at room temperature of 18-21°C with completely horizontal position of body and limbs with the Gesenius-Keller apparatus (ref. 5), which permits simultaneous oscillography at two places. We insisted on complete rest and relaxation before the tests. /202

The examination began with lying down for 10 minutes. Oscillography was done simultaneously on the right forearm and right leg. After half a minute the flow of blood through the limb was cut off by pumping up the cuff to 30-40 mm Hg above the systolic blood pressure of the brachial artery for 2-1/2 or 5 min.

Shortly before reestablishing the blood flow, the blood pressure (according to Korotkoff) in the brachial artery of the nonischemic arm was measured again. During the 15 sec after reestablishment of blood flow in the limbs we took another arterial oscillogram at the same place (ref. 1). Oscillations were registered during decompression, in intervals of 20 mm Hg each, in the region of 120-60 mm Hg in intervals of 10 mm Hg each.

We determined the degree of oscillation with an accuracy of 0.2 mm on the oscillograms. Statistical analysis considered the changes of the oscillometric index (OI), and the upper and lower large oscillations of the first and second order (OG01 and UG01, OG02 and UG,02, fig. 1).

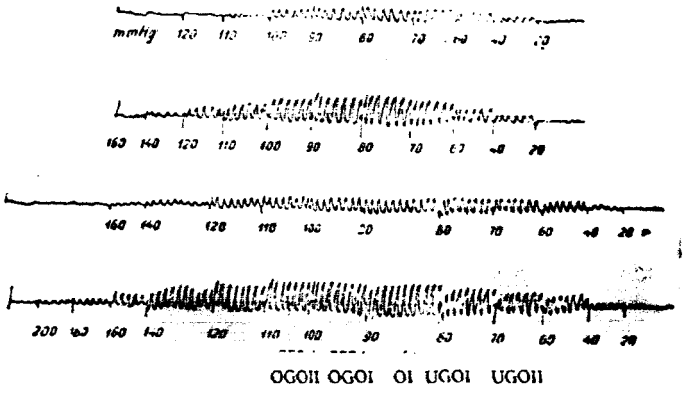

Figure 1. Oscillograms of right forearm and leg of 62-year-old person. Top, oscillogram before ischemia; bottom, oscillogram after 2-1/2 min of ischemia. OI, oscillometric index: OGO1 and OGO2--upper large oscillations of first and second order; UGO1 and UGO2--lower large oscillations of first and second order.

Results and Discussion. The results are presented in tables 1 and 2.

Table 1 shows that in younger as well as in older persons a nearly similar increase of oscillations in the forearm occurs after 2-1/2 min of ischemia. In older persons the increase in oscillations in the leg is considerably less than in the forearm, and than in the leg of younger persons. The relation between the percent increase of OI, OGO1, UGO1, OGO2 and UGO2 of the forearm and the leg in younger persons is 1,4, 1,3, 1,3, 1,1, respectively 1,1 and in the older persons 1,8, 2,5, 1,6, 1,8 respectively 1,3. The same relationship is shown in table 2, which presents the OI changes in 16 younger and 16 older persons after 5 min of ischemia of the forearm and leg.

Table 2 shows that the relation between the percentof OI changes of forearm and leg in younger persons is 0.97 and in older persons is 1.9.

TABLE 1

		Forearm			Leg			Relation between % increase of osc. in arm and leg
		Before ischemia	After 2.30 min of ischemia	Increase %	Before ischemia	After 2.30 min of ischemia	Increase %	
OI	73 older persons	9,59±0,29	13,20±0,33	37,6	11,58±0,38	13,93±0,37	20,3	1,8
	40 younger persons	7,79±0,35	10,76±0,40	38,1	10,18±0,45	12,80±0,51	25,7	1,4
OGO I	older	8,12±0,28	11,89±0,35	46,4	10,85±0,35	12,79±0,28	17,9	2,5
	younger	7,13±0,35	9,24±0,42	30,0	9,35±0,43	11,48±0,45	22,7	1,3
UGO I	older	8,47±0,27	11,47±0,35	35,4	10,41±0,37	12,62±0,42	21,1	1,6
	younger	6,69±0,35	9,39±0,36	40,3	8,93±0,41	11,58±0,40	29,7	1,3
OGO II	older	7,61±0,26	10,09±0,31	32,5	9,65±0,31	11,41±0,36	18,2	1,8
	younger	5,81±0,29	7,36±0,30	26,6	8,16±0,38	10,10±0,30	23,7	1,1
UGO II	older	6,75±0,28	8,79±0,33	30,2	8,19±0,40	10,13±0,35	23,6	1,3
	younger	5,29±0,24	6,95±0,31	31,3	6,44±0,42	18,27±0,33	28,4	1,1

TABLE 2

	Forearm			Leg			Relation between % increase of osc. in arm and leg
	Before ischemia	After five min of ischemia	Increase %	Before ischemia	After five min of ischemia	Increase %	
16 older persons	10,02±0,33	13,45±0,40	34,2	13,17±0,35	15,61±0,38	18,5	1,9
16 younger persons	7,51±0,36	9,73±0,34	29,5	7,67±0,30	10,00±0,40	30,3	0,97

Extending the duration of ischemia from 2-1/2 min to 5 min does not show any statistically certain changes in the increase of oscillations.

We emphasize the the changes due to ischemia are local in character (refs. 6 and 7), expressed in diminished vascular tone and appearance of a reactive hyperemia. The cause of the increase of the oscillations after ischemia is only the diminished vascular tone, not the increase in systolic discharge, changes in blood pressure (which we did not observe) or the appearance of a reactive hyperemia (ref. 3).

These results support the opinion that the arteries of the lower limbs become increasingly rigid with time and lose their adaptive capacities, since they are more heavily affected by hydrostatic pressure (ref. 8).

The plateau-type oscillometric curve, pointed out by several authors (refs. 2, 4 and 9), which is typical for sclerotic arteries, was frequently observed in our investigations in the older subjects. However, this curve cannot be used for a more accurate quantitative determination of the degree of sclerosis of the upper and lower limbs.

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